

Applicants respectfully submit that these references were cited in related applications and were submitted with English language translations of their Abstracts at that time. However, in order to expedite this matter, copies of the previously-filed English language Abstracts for all the references not considered in the previously filed Information Disclosure Statements (Papers 8, 9 and 10) are attached. Clean copies of Forms 1449 filed with the Information Disclosure Statements identified as Papers 8, 9 and 10 are also attached.

II. Claims 25-46 and 54-75 Satisfy the Requirements of 35 U.S.C. §112, First Paragraph

The Office Action rejects claims 25-46 and 54-75 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification. The Office Action asserts that the specification provides no support for the term "semiconductor." Specifically, the Office Action, at pages 2 and 3, asserts that

While some of their EL materials **may be** semiconductors (polyvinylcarbazol), there are many semiconductors, which are not EL materials. The applicants have attempted to expand the scope of their claims to include materials, which the original disclosure never conceived of. The applicants are clearly using inkjet methods to print substrates with EL polymers or blends of EL polymers with dyes, there is no reason to believe that the disclosure at the time the invention was made was meant to encompass all forms of "semiconductor" materials as now claimed.

This assertion is respectfully traversed.

The Office Action seems to assert that the specification only describes ink jetting luminescent semiconducting polymer materials or blends of electroluminescent semiconducting polymer materials with dyes to form layers or patterns on a substrate, and does not support the broad recitation of ink jetting organic semiconducting materials. Applicants respectfully disagree with and request reconsideration of the Office Action's interpretation of the specification.

A. THE SPECIFICATION PROVIDES A WRITTEN DESCRIPTION OF INK JETTING SEMICONDUCTING ORGANIC MATERIALS

Applicants respectfully submit that the specification, as originally filed, provides full, clear and concise support for the claims in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

The specification fully and clearly describes a process for forming a pattern on a substrate by deposition of an organic material comprising, inter alia, depositing a semiconducting organic material in a solvent onto a substrate by ink-jet printing, as claimed in independent claim 25.

The specification fully and clearly describes organic materials that are all semiconducting organic materials and ink jetting them to form luminescent layers as well as non-luminescent layers.

1. Ink Jetting Semiconducting Organic Materials to Form a Luminescent Layer

The specification, at page 3, lines 1-15, describes depositing a luminescent organic material or compound on a substrate by ink-jet printing:

the manufacturing method of an organic EL element according to the present invention comprises...forming on the pixel electrodes by patterning at least one luminescent layer having a certain color and made of an organic compound, ...wherein the formation of the luminescent layers is performed by means of an ink-jet method.

In the present invention, it is preferable that the organic compound is a polymer organic compound. (emphasis added)

In addition to the example provided above, the specification describes depositing a luminescent organic material or compound on a substrate by ink-jet printing in numerous places throughout the specification, including at least at page 3, lines 24-28, page 4, lines 12-23, page 7, lines 1-4, page 8, lines 12-18, page 8, line 34 to page 9, line 2, and page 9, line 16.

Thus, Applicants respectfully submit that the specification clearly and fully describes ink jetting an organic material on a substrate to form a luminescent layer in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

Further, the specification, page 12, line 5 to page 13, line 6, describes examples of luminescent organic materials or compounds that can be deposited by ink jetting:

[a]s for materials for the organic luminescent layers, polymer organic compound itself, precursor of conjugated organic polymer compound which is to be conjugated (to form a film) by heating or the like, and other materials are used. (Specification, at page 12, line 5 to page 13, line 6, emphasis added)

It was well known to those skilled in the art to which this invention pertains that conjugated polymers are semiconducting organic materials. For example, "The electroluminescence of organic materials," Ullrich Mitschke et al., J. Mater. Chem., Vol. 10, pgs. 1471-1507 (2000) (hereinafter "Mitschke Reference") (copy enclosed), explicitly states at page 1472 that "[c]onjugated polymers are organic semiconductors with delocalized π -molecular orbitals along the polymeric chain."

The Mitschke Reference, at page 1473, explicitly identifies luminescent organic semiconducting materials, including for example PPV (poly(para-phenylene vinylene)) or its derivative, which are disclosed in Applicants' specification, at least at page 12, line 30 to page 13, line 3.

Further, the specification, at page 12, lines 5-11, clearly and fully describes that the organic polymer materials used to form a luminescent layer are semiconducting organic polymer materials:

polymer organic compounds have a band gap in the visible region and a relatively high electrical conductivity. Among such polymer organic compounds, a conjugated polymer can exhibit such properties prominently. (emphasis added)

As discussed in "Fabrication of Organic Light-Emitting Devices," Jennifer Reinig, Iowa State Univ., 2001 (hereinafter "Reinig Reference") (copy attached), just like inorganic semiconducting materials, an organic semiconducting material has an energy gap (or band gap) between its LUMO (Lowest Unoccupied Molecular Orbital) level and its HOMO (Highest Occupied Molecular Orbital) level that enables the material to emit visible light. The wavelength of emitted light can be controlled by modifying the chemical structure of the conjugated organic material. Thus, emission of light is possible for conjugated organic materials by "chemical" tuning the energy gap between the HOMO level and the LUMO level of the organic semiconducting material.

Thus, Applicants respectfully submit that the specification clearly and fully describes ink jetting a luminescent semiconducting organic material on a substrate in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

2. Ink Jetting Semiconducting Organic Materials to Form a Non-Luminescent Layer

The Office Action, at pages 2 and 3, acknowledges that the specification clearly describes depositing an electroluminescent (EL) polymer material or blends of EL polymers with dyes on a substrate by ink-jet printing to form a luminescent layer.

Applicants respectfully submit that the specification, as originally filed, also provides full, clear and concise support for ink jetting organic semiconducting materials to form not only luminescent layers, such as blue, green or red electroluminescent (EL) layers, but also to form non-luminescent layers, that is layers which do not function as luminescent layers in devices. Examples of such layers that do not function as luminescent layers in devices include hole injection and transfer layers and electron injection and transfer layers.

a. Ink Jetting Semiconducting Organic Material to Form Non-Luminescent Hole Injection and Transfer Layer

The specification, at page 20, line 6 to page 21, line 2, fully and clearly describes depositing a semiconducting organic material or compound on a substrate by ink-jet printing to form a non-luminescent hole injection and transfer layer:

[t]his second embodiment is different from the first embodiment in the point that a hole injection and transfer layer 208 is formed on the pixel electrode 203 and then a blue luminescent layer 210 is laminated on the layer 208.

....

It is preferable that the hole injection and transfer layer 208 is a non-luminescent layer....

No particular limitation is imposed upon the forming method for such a hole injection and transfer layer 208, but for example, it is possible to form the layer by using the ink-jet method. In this way, it becomes possible to arrange the hole injection and transfer layer 208 precisely with a predetermined pattern. (emphasis added)

In addition to the example provided above, the specification describes depositing an organic material or compound on a substrate by ink-jet printing to form a non-luminescent hole injection and transfer layer in numerous places throughout the specification, including at least at page 22, lines 4-6, and page 23, line 31 to page 24, line 3.

Further, the specification, at page 20, lines 27-28, page 21, line 35 to page 22, line 2, and page 24, lines 1-3, explicitly describes that it is preferable "that the hole injection and transfer layer...is formed into a non-luminescent layer."

Thus, Applicants respectfully submit that the specification clearly and fully describes depositing an organic material on a substrate by ink-jet printing to form a non-luminescent layer in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

Further, the specification, page 21, line 5 to page 13, line 6, clearly and fully describes as examples semiconducting organic materials for non-luminescent layers that can be deposited by ink jetting:

[a]s for examples of the material constituting the hole injection and transfer layer 208, aromatic diamine based compound such as TPD; MTDATA; quinacridone; bisstil anthracene derivative; PVK (polyvinyl carbazole); phthalocyanine based complex such as copper phthalocyanine; porphin based compound; NPD; TAD; polyaniline; and the like can be mentioned. Among these materials, PVK is particuraly preferred. By using PVK, it becomes possible to form a non- luminescent hole injection and transfer layer. (emphasis added)

It was well known to those skilled in the art to which this invention pertains that all of these organic materials disclosed in the specification are semiconducting organic materials.

For example, Figure 1.2 of "Opto-Electronic Properties of Disordered Organic Semiconductors," Michel C. Vissenberg (1999) (hereinafter "Vissenberg Reference"), at page 5 (copy attached), explicitly identifies PVK, aromatic diamine based compounds, such as TPD, and anthracene derivatives as organic semiconducting materials. Further, Figure 1 of "Electroluminescence in conjugated polymers", R. H. Friend et al., Nature, vol. 397 (Jan. 14, 1999) (hereinafter "Friend Reference") also explicitly identifies TPD as a semiconducting material that is used as a hole transport layer.

The Reinig Reference, at pages 5-12, also explicitly identifies various materials, such as NPD, TPD and phthalocyanine based complex such as copper phthalocyanine (CuPc) (disclosed in the specification at page 21, lines 3-10) as semiconducting organic materials that can be used to form a non-luminescent layer, for example a hole injection and transfer layer.

Moreover, the Mitschke Reference, at pages 1472-73 and 1490-91, explicitly identifies polyaniline, TPD, PVK (disclosed in the specification at least at page 21, lines 3-

10) and other organic materials as semiconducting organic materials that can be used to form a non-luminescent layer, for example a hole injection and transfer layer.

Further, Applicants' related U.S. Patent Application Serial No. 09/901,095, at least at page 50, line 21 to page 51, line 23, clearly, fully and specifically describes MTDATA, quinacridone, porphyrin complex and other materials to form an "organic semiconductor film" (emphasis added).

Thus, Applicants respectfully submit that the specification clearly and fully describes ink jetting a semiconducting organic material to form a non-luminescent layer on a substrate in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

b. Ink Jetting Semiconducting Organic Material to Form Non-Luminescent Electron Injection and Transfer Layer

The specification, at page 22, line 33 to page 23, line 13, fully and clearly describes depositing a semiconducting organic material on a substrate by ink-jet printing to form an electron injection and transfer layer:

an electron injection and transfer layer 811 is formed on the luminescent layers 806, 807 and 808...

In this connection, the forming method for the electron injection and transfer layer 811 is not limited to this method, and for example, the ink-jet method, vacuum deposition method, dipping method, spin coating method, casting method, capillary method, roll coating method, bar coating method or the like can be used. (emphasis added)

In addition to the example provided above, the specification describes ink jetting an organic material or compound on a substrate to form an electron injection and transfer layer in numerous places throughout the specification, including at least at page 9, line 33 to page 10, line 14 and page 36, lines 20-24.

Thus, Applicants respectfully submit that the specification again clearly and fully describes depositing an organic material on a substrate by ink-jet printing to form an electron

injection and transfer layer in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

Further, the specification, at page 10, lines 4-14 and at page 23, lines 3-5, provides as examples semiconducting organic materials that can be deposited by ink jetting to form an optionally-luminescent electron injection and transfer layer:

as for an organic compound which can form an electron injection and transfer layer, oxadiazole derivative such as PBD, OXD-8 and the like, DSA, aluminum quinolinol complex, Bebq, triazole derivative, azomethine complex, porphine complex, benzoxadiazol and the like can be mentioned. In this case, an electron injection and transfer layer can be formed from just one of these materials, or formed by mixing or laminating one of or two or more of them. (Specification at page 10, lines 4-14)

[a]s for the electron injection and transfer layer 811, aluminum quinolynol complex to which the doping is not carried out can be used. (Specification, at page 23, lines 3-5)

As discussed above, the Reinig Reference, at page 10, presents energy gap values for various organic semiconducting materials, including some organic semiconducting materials such as PBD and aluminum quinolinol complex, which are also disclosed in Applicants' specification, at least at page 10, lines 4-14, and page 23, lines 3-5.

Further, the Reinig Reference, at pages 5-12, also explicitly identifies various materials, such as aluminum quinolynol complex (disclosed in the specification at page 23, line 4) as semiconducting organic materials than can be used to form a non-luminescent layer, for example an electron injection and transfer layer.

Moreover, Applicants' related U.S. Patent Application Serial No. 09/901,095, at least at page 50, line 21 to page 51, line 23, clearly, fully and specifically describes PBD, OXD-8 and the like, DSA, aluminum quinolinol complex, porphine complex, benzoadiazol and other materials to form an "organic semiconductor film" (emphasis added).

Thus, Applicants respectfully submit that the specification clearly and fully describes ink jetting a semiconducting organic material to form a non-luminescent layer on a substrate

in such a way as to reasonably convey to one skilled in the art that the inventors had possession of the claimed invention at the time the application was filed.

III. Conclusion

In view of the foregoing discussion, Applicants respectfully submit that the specification, as originally filed, provides full, clear and concise support for a process for forming a pattern on a substrate by deposition of an organic material comprising, inter alia, depositing a semiconducting organic material in a solvent onto a substrate by ink-jet printing, as claimed in independent claim 25.

Applicants further submit that the specification, as originally filed, describes organic materials that are all semiconducting organic materials and that are used to form both luminescent and non-luminescent layers, such as for example an electroluminescent layer, a non-luminescent hole injection and transfer layer or an optionally luminescent electron injection and transfer layer.

Withdrawal of the rejection of claims 25-46 and 54-75 under 35 U.S.C. §112, first paragraph, is respectfully requested.

In view of the foregoing remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt allowance of claims 25-46 and 54-78, and declaration of a consolidated interference as defined in Applicants' February 27, 2002, Request for Declaration of Interference and Petition for Consolidation of Three Interferences (decided July 3, 2002), are earnestly solicited.

Should the Examiner believe that anything further is desirable in order to place this application in better condition for allowance and declaration of an interference, the Examiner is requested to contact Applicants' representative at the telephone number listed below.

Respectfully submitted,



James A. Oliff
Registration No. 27,075

George P. Simion
Registration No. 47,089

JAO:GPS/can

Attachments:

Appendix
Petition for Extension of Time
Information Disclosure Statement w/ 1449

Date: March 20, 2003

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE
AUTHORIZATION
Please grant any extension
necessary for entry;
Charge any fee due to our
Deposit Account No. 15-0461

APPENDIX

Changes to Specification:

Page 12, line 30 to page 13, line 3:

As for examples of an organic compound which can form the luminescent layers,
polyalkylthiophene such as PTV (poly(2,5-thienylene vinylene)) and the like; PPV
(poly(para-phenylene vinylene)) or its derivative; ~~PTV (poly(2,5-thienylene vinylene)) and~~
~~the like; polyallylene polyarylene~~ vinylene such as PFV (poly(2,5-furylene vinylene))
polyparaphenylene, polyalkylfluorene and the like; pyrazoline dimer; quinolizine carboxylic
acid; benzopyrylium perchlorate; benzopyranoquinolizine; rubrene; phenanthroline europium
complex and the like can be mentioned. In this case, just one of them or a mixture of two or
more of them can be selectively used.